Attorney's Docket No.:   13361-050001
Client's Ref. No.:   MP0256

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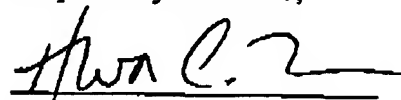| | | | |
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| Applicant: | Ravi Narasimhan | Art Unit: | 2617 |
| Serial No.: | 10/656,001 | Examiner: | Huy Q. Phan |
| Filed: | September 5, 2003 | | |

Title:     Spatial Multiplexing with Antenna and Constellation Selection for Correlated MIMO Fading Channels

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

A Reply Brief dated **August 20, 2007** is attached.

Respectfully submitted,

Date: August 20, 2007

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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|---|---|---|---|
| Applicant: | Ravi Narasimhan | Art Unit: | 2617 |
| Serial No.: | 10/656,001 | Examiner: | Huy Q. Phan |
| Filed: | September 5, 2003 | Conf. No.: | 7519 |
| Title: | SPATIAL MULTIPLEXING WITH ANTENNA AND CONSTELLATION SELECTION FOR CORRELATED MIMO FADING CHANNELS | | |

**Mail Stop Appeal Brief - Patents**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

<u>REPLY BRIEF</u>

Pursuant to 37 C.F.R. § 41.41, Applicant responds to the Examiner's Answer Dated June 18, 2007 as follows:

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## REMARKS

### Rejections Under 35 U.S.C. § 103(a)

Claims 2, 4-8, 10, 13, 15-19, 21, 24, 26-30, 32, 35, 37-41, 43, 46, 48-52, 54 and 57 were

rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over U.S. Patent Application

Publication Number 2003/0223391 to Malaender ("Malaender") in view of U.S. Patent Number

6,801,580 to Kadous ("Kadous").

### Claim 4 and its dependent claim

Claim 4 recites a method that includes selecting a subset of active antennas from a

plurality of available antennas in a multi-element antenna system based on higher-order

statistics of a propagation medium. Claim 4 also recites selecting a constellation for

transmission on the active antennas, where said selecting the constellation for transmission on

the active antennas comprises selecting different constellations for two or more of the active

antennas. Applicant's specification provides an example. "As a result of antenna and

constellation selection, Antennas 1, 2, and 3 transmit a 16-QAM constellation for the linear and

V-BLAST system. For the SCR system, Antennas 1 through 5 are active with transmit

constellations 8-PSK, 8-PSK, QPSK, QPSK, and QPSK, respectively." (Applicant's

Specification at ¶ 52.)

The Office concedes that Malaender does not teach or suggest selecting a constellation

for transmission on the active antennas including selecting different constellations for two or

more of the active antennas. (*See,* Examiner's Answer at pg. 3, 1. 24 – pg. 4, 1. 2.) In an attempt

to alleviate this deficiency of Malender, the Office contends that "Kadous shows in figure 5 (see

fig. 5 and its description) a transmission system with a various number of transmitted antennas

(124a-124t) and each of transmitted antennas transmits each of data streams with specific data

rate selection, separate coding and modulation scheme ('per antenna basis'; see col. 17)." (*See,* Examiner's Answer at pg. 13, ll. 12-16.) The Office also contends that Kadous "describes that the coded data for each data stream is modulated based on one or more constellation selection (e.g., BPSK, QSPK, M-PSK, or M-QAM) to provide the specific modulation symbol (see fig. 1 and col. 4, lines 31-67) and each specific modulation symbol is selected for each transit antenna (col. 18, lines 15-17). However, upon further review, the cited portions of Kadous fails to support the contention.

Kadous teaches "techniques to process a number of received symbol streams, using successive interference cancellation (SIC) processing, to recover a number of transmitted symbol streams." (*See* Kadous at Col. 3, ll. 43-48. Emphasis added.) Thus, Kadous is directed to merely processing the received symbol streams. Kadous does not teach or suggest varying the number of antennas or the constellations selected for the antennas in a transmission system. In contrast to claim 4, Kadous teaches that the received symbol streams are transmitted from a set number of antennas, all having the same predetermined constellation. (*See,* Kadous at Col. 14, ll. 6-10.) For example, the cited portions of Kadous disclose that "performance [of various SIC processing schemes] is provided for a (2,4) MIMO system with two transmit antennas and four receive antennas, and which uses 16-QAM with rate 1/2 Turbo coding." (*See* Kadous at Col. 14, ll. 6-10; FIG. 4. Emphasis added.) Therefore, all of the antennas in Kadous use the same constellation, 16-QAM. In fact, Kadous is silent as to selecting different constellations for two or more of the active antennas (i.e., at least two different constellations for two antennas) and nothing in Kadous can be reasonably construed to teach or suggest otherwise.

Therefore, even if Malaender and Kadous could somehow be combined, which is not conceded, the combination would still fail to disclose each and every feature of claim 4. Accordingly, Applicant respectfully asserts that claim 4 as presented is allowable over the suggested combination of Malaender and Kadous for at least the above reasons.

Claims 2, 5, 6, 8 and 10 depend from claim 4 and are allowable over the proposed combination of Malaender and Kadous for at least the same reasons.

Claim 7

Claim 7 is directed to a method that includes selecting a subset of active antennas from a plurality of available antennas in a multi-element antenna system where the selecting comprises selecting an optimum number of antennas to maximize a minimum signal-to-noise ratio (SNR) margin.

The Office concedes that Malaender does not teach or suggest Applicant's claimed method including selecting an optimum number of antennas to maximize a minimum signal-to-noise ratio (SNR) margin in a multi-element antenna system. In an attempt to alleviate this deficiency of Malender, the Office contends that Kadous teaches the claimed features. (See, Examiner's Answer at pg. 14, ll. 12-21.) However, upon further review, the cited portions of Kadous fails to support the contention.

The Office reasons that because "each symbol stream [in Kadous] is determined based on SNR (for details see cols. 11-18)", Kadous teaches "selecting an optimum number of antennas to maximize minimum signal-to-noise (SNR) margin." (See, id.). However, Kadous teaches that "metrics are provided herein that may be used as indications of the quality of goodness of a detected symbol stream", and these metrics are derived "based on post-detection SNR". (See, Kadous at Col. 11, ll. 43-47.) Thus, Kadous uses the SNR of the detected signal (i.e., after

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transmitting the signal) to determine the quality of the received signal. Kadous does not teach or

suggest that an optimum number of antennas is selected to maximize minimum signal-to-noise

(SNR) margin as recited in claim 7. In fact, an optimum number of antennas is not selected in

Kadous to maximize a minimum SNR margin in a multi-element antenna system or for any other

reasons. Accordingly, Applicant respectfully asserts that claim 7 is allowable over the

combination of Malaender and Kadous for at least the above reasons.

Claim 15 and its dependent claims.

Claim 15 should be allowable over the proposed combination of Malaender and Kadous

for at least reasons similar to claim 4. In particular, the proposed combination fails to at least

teach or suggest, "[a]n apparatus comprising: a processor operative to select a subset of active

antennas from a plurality of available antennas based on higher-order statistics of a propagation

medium, wherein the processor is operative to select a constellation for transmission on the

active antennas and to select different constellations for two or more of the active antennas" as

recited in claim 15. (Emphasis added.)

Claims 13, 16, 17, 19 and 21 depend from claim 15 and are allowable over the

combination of Malaender and Kadous for at least the same reasons as claim 15.

Claim 18

Claim 18 should be allowable over the proposed combination of Malaender and Kadous

for at least reasons similar to claim 7. In particular, the proposed combination fails to at least

teach or suggest, "[a]n apparatus comprising: a processor operative to select a subset of active

antennas from a plurality of available antennas based on higher-order statistics of a propagation

medium where the processor is operative to select an optimum number of antennas to maximize

a minimum signal-to-noise ratio (SNR) margin" as recited in claim 18. (Emphasis added.)

<u>Claim 26 and its dependent claims</u>

Claim 26 should be allowable over the proposed combination of Malaender and Kadous for at least reasons similar to claim 4. In particular, the proposed combination fails to at least teach or suggest, "[a]n apparatus comprising: a processor including means for selecting a subset of active antennas from a plurality of available antennas based on higher-order statistics of a propagation medium and means for selecting a constellation for transmission on the active antennas including <u>means for selecting different constellations for two or more of the active antennas</u>" as recited in claim 26. (Emphasis added.)

Claims 24, 27, 28, 30 and 32 depend from claim 26 and are allowable over the combination of Malaender and Kadous for at least the same reasons as claim 26.

<u>Claim 29</u>

Claim 29 should be allowable over the proposed combination of Malaender and Kadous for at least reasons similar to claim 7. In particular, the proposed combination fails to at least teach or suggest, "[a]n apparatus comprising: a processor including means for selecting a subset of active antennas from a plurality of available antennas based on higher-order statistics of a propagation medium, <u>where said selecting comprises selecting an optimum number of antennas to maximize a minimum signal-to-noise ratio (SNR) margin</u>" as recited in claim 29. (Emphasis added.)

### Claim 37 and its dependent claims

Claim 37 should be allowable over the proposed combination of Malaender and Kadous for at least reasons similar to claim 4. In particular, the proposed combination fails to at least teach or suggest, "[a] system comprising: a propagation medium; a first transceiver including a plurality of available antennas; a second transceiver including a plurality of available antennas, a processor operative to determine higher-order statistics of the propagation medium from signals received from the plurality of available antennas at the first transceiver; and an antenna selection module operative to select a subset of active antennas from the plurality of available antennas based on higher-order statistics of the propagation medium, where the processor is operative to select a constellation for transmission on the active antennas and select different constellations for two or more of the active antennas" as recited in claim 37. (Emphasis added.)

Claims 35, 38, 39, 41, and 43 depend from claim 37 and are allowable over the proposed combination of Malaender and Kadous for at least the same reasons as claim 37.

### Claim 40 and its dependent claims

Claim 40 should be allowable for at least reasons similar to claim 7. In particular, the proposed combination fails to at least teach or suggest, "[a] system comprising: a propagation medium; a first transceiver including a plurality of available antennas; a second transceiver including a plurality of available antennas, a processor operative to determine higher-order statistics of the propagation medium from signals received from the plurality of available antennas at the first transceiver; and an antenna selection module operative to select a subset of active antennas from the plurality of available antennas based on higher-order statistics of the

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propagation medium, where the processor is operative to select an optimum number of antennas

to maximize a minimum signal-to-noise ratio (SNR) margin" as recited in claim 40. (Emphasis

added.)

Claim 57 depends from claim 40 and is allowable over the proposed combination of

Malaender and Kadous for at least the same reasons as claim 40.

Claim 48 and its dependent claims

Claim 48 should be allowable over the proposed combination of Malaender and Kadous

for at least reasons similar to claim 4. In particular, the proposed combination fails to at least

teach or suggest, "[a] computer program comprising the steps of: selecting a subset of active

antennas from a plurality of available antennas in an multi-element antenna system based on

higher-order statistics of a propagation medium; and selecting a constellation for transmission on

the active antennas including selecting different constellations for two or more of the active

antennas" as recited in claim 48. (Emphasis added.)

Claims 46, 49, 50, 52 and 54 depend from claim 48 and are allowable over the proposed

combination of Malaender and Kadous for at least the same reasons as claim 48.

Claim 51

Claim 51 should be allowable over the proposed combination of Malaender and Kadous

for at least reasons similar to claim 7. In particular, the proposed combination fails to at least

teach or suggest, "[a] computer program comprising the steps of: selecting a subset of active

antennas from a plurality of available antennas in an multi-element antenna system based on

higher-order statistics of a propagation medium where said selecting comprises selecting an

optimum number of antennas to maximize a minimum signal-to-noise ratio (SNR) margin" as

recited in claim 51. (Emphasis added.)

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For these reasons, and the reasons stated in the Appeal Brief, Applicant submits that the

final rejection should be reversed.

Please apply any charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

Date: August 20, 2007

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